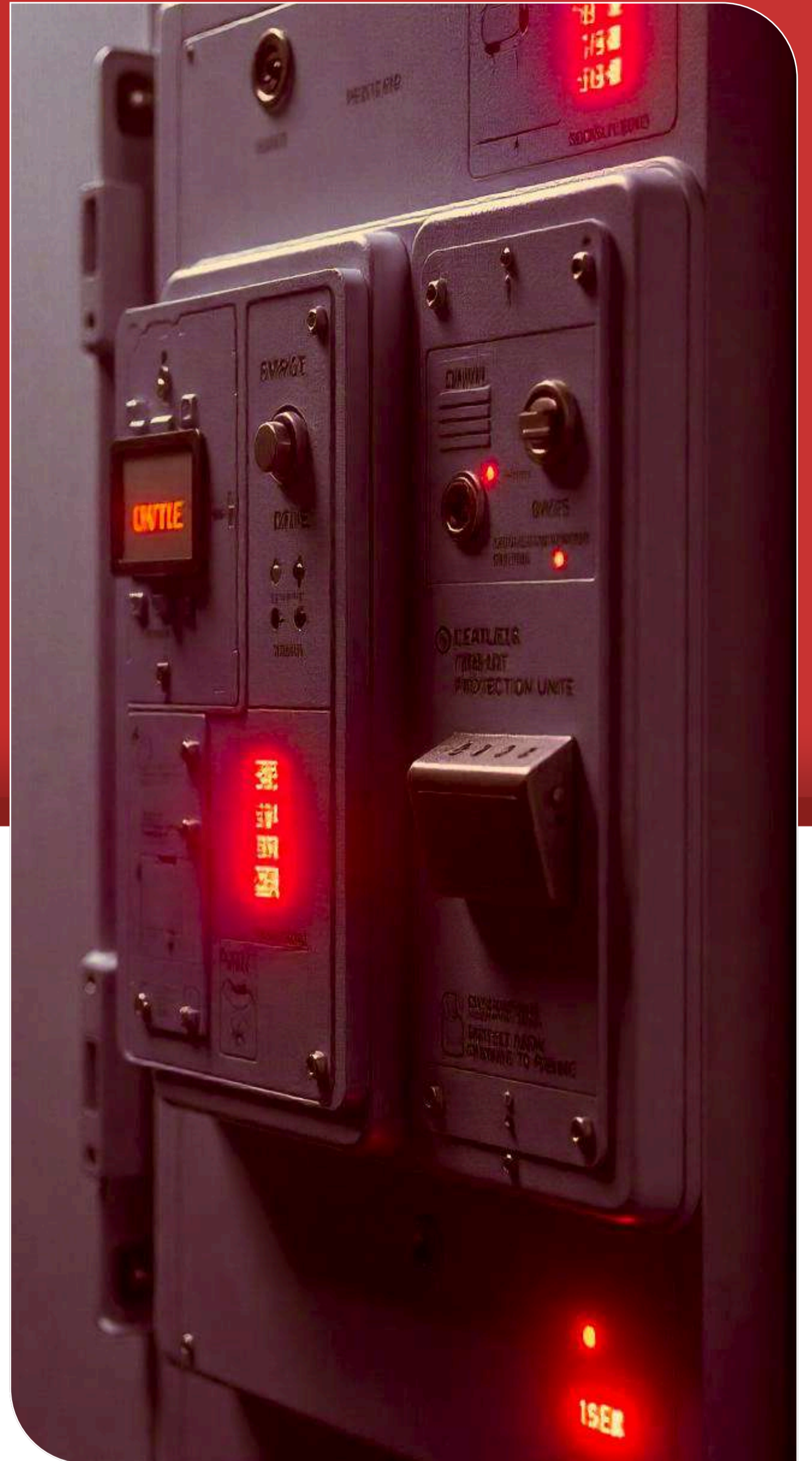


INVALIDATION CASE STUDY

CURRENT LEAKAGE DETECTION AND PROTECTION DEVICE

OVERVIEW

The patent under scrutiny claimed a device designed to detect and protect against leakage current in a power cord. It comprises a switch unit that manages the electrical connection between the input and output ends and a leakage current protection unit with a switch drive module and a leakage current detection module. The detection module uses a detection line to check for leakage current on power supply lines and a signal feedback line to monitor the detection line's circuit status. Additionally, a test unit with a test switch interacts with the protection unit to simulate conditions where the switch drive module operates based on feedback signals.



Our objective was to invalidate the patent by identifying prior art that either directly disclosed or suggested these features through a combination of references, thereby challenging its novelty and non-obviousness.

CHALLENGES

The patent's novelty hinged on three key features:

▶ The power cord leakage current detection and protection device includes a switch unit. This switch unit was configured to control the electrical connection between the device's input and output ends.

▶ The leakage current protection unit includes a switch drive module and a leakage current detection module. The switch drive module controls the switch unit based on the leakage current signal detected by the detection module.

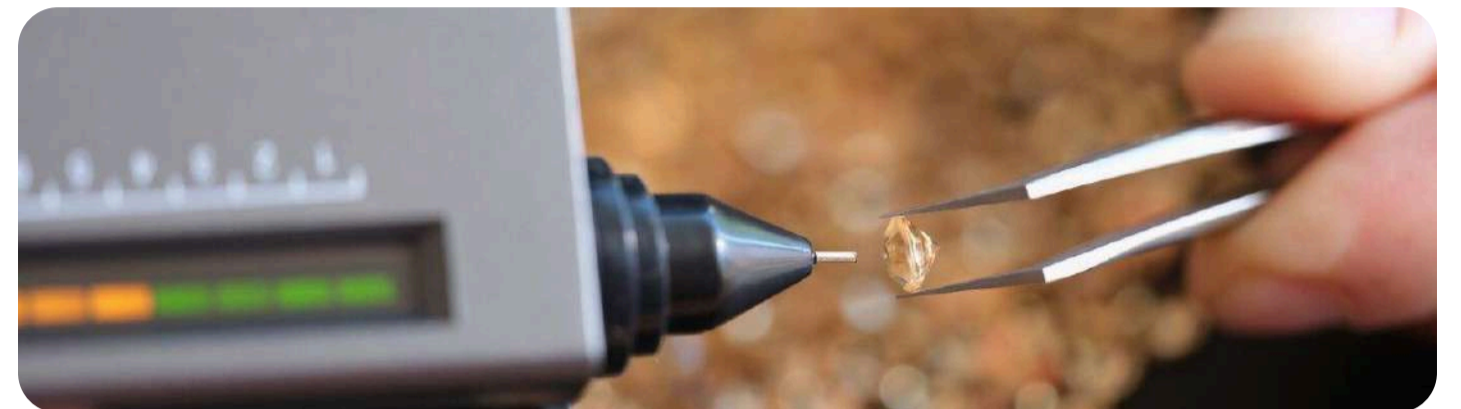
▶ The leakage current detection module includes: a leakage current detection line, configured to detect whether a leakage current was present on a first power supply line and/or a second power supply line, and a signal feedback line, configured to detect whether the leakage current detection line has an open circuit; and a test unit, including a test switch, coupled to a leakage current protection unit.

We needed to demonstrate that these features were either already disclosed in prior art or could be derived from a combination of existing technologies to invalidate the patent.

INITIAL SEARCH STRATEGY

Initial searches using keywords like "leakage current detection", "power cord", "power supply", and "test module" yielded limited results.

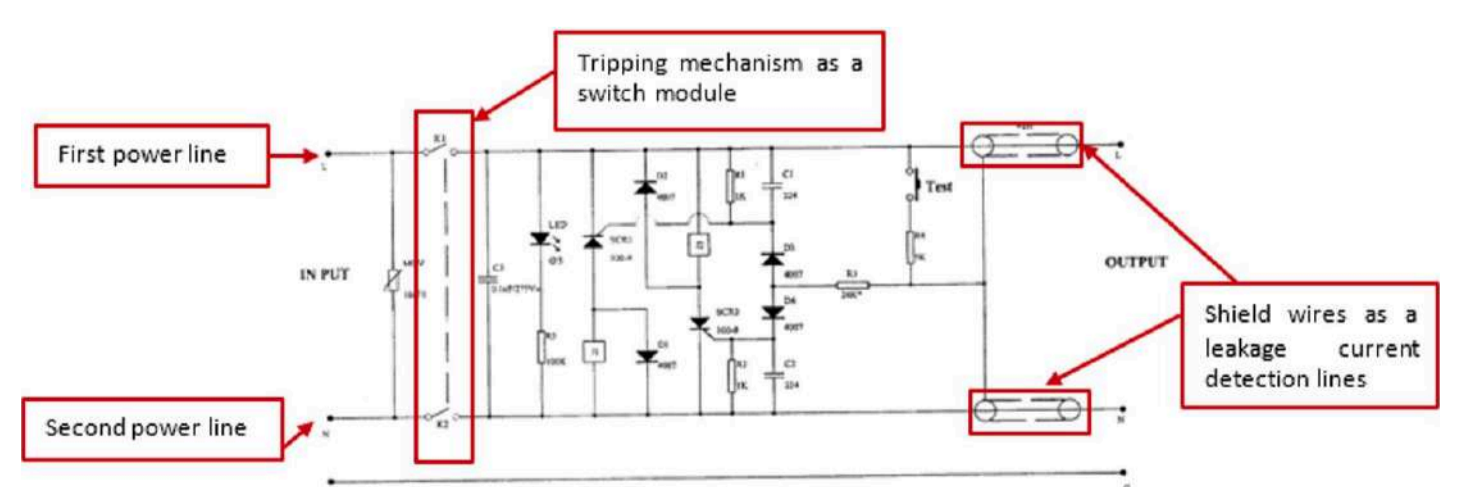
There were no rejections during the office action, so we must focus on every feature of the claim. The scope of the invention's claim was very narrow. Several references and devices were available for detecting and protecting against leakage current, but the specific feature related to signal feedback and test unit narrows the claim significantly.



INVALIDATION SEARCH CHALLENGES

Most of the references in our search results disclose leakage detection devices that were separate from the power plug. However, we seek a patent that discloses a leakage current detection line inside the cable alongside the other line. In this case, excluding that type of reference from our result set was difficult.

▶ **Signal Feedback line:** Some prior art discloses an LCDI (Leakage Current Detection and Interruption), primarily comprising a tripping mechanism, two shielded wires covering a live core and a neutral core, respectively, and a current leakage detection unit. However, it fails to disclose that the inclusion of the signal feedback line was coupled via the first detection module to one of the first and second power supply lines.



▶ The inventor of the subject patent utilized common components often employed in such inventions, including wires, switch circuits, and detection lines. As a result, we were reserved in our ability to use the same keywords, leading to a high volume of search results. Consequently, we need to analyze a large number of references and filter out the most relevant ones.

▶ Few of the references were already known to the client, as he had previously shared a list of known references with us. So, we had a feeling that this wasn't going to be an easy task.

REFINED SEARCH STRATEGY

After being unable to get better results after our initial search, we decided to brainstorm with our team regarding our logics and ideology so that we can get better results. We refined the search with the following steps:

▶ **Expanded Terminology:** Broadened terms to include "Fault Detection," "Current Drain," "Protection Layer," and "Shield Line" to capture alternative phrasing.

▶ **IPC/CPC Code Integration:** Prioritized codes like G01R31/52 (Testing for short-circuits, leakage current, or groundfaults), G01R31/58 (Testing of lines, cables, or conductors), and H01B7/32 (Insulated conductors or cables characterized by their form with arrangements for indicating defects, e.g., breaks or leaks) to target technical specifics.

▶ **Combining Keywords and Classes:** Used terms like "Fault Detection," "Current Drain," "Protection Layer," and "Shield Line" alongside classification codes like G01R31/58 (Testing) and H01B7/32 (cable leaks).

▶ **Global Prior Art:** Included patents and applications from Japan, South Korea, and China to uncover region-specific innovations.

▶ **Assignee Analysis:** Focused on patents filed by leading cable manufacturers (e.g., Leviton Manufacturing Co INC, Siemens) to identify advanced sealing and polarization technologies.

▶ **Inventor Analysis:** Investigated prolific inventors in cable leakage detection, particularly those with expertise in cable architectures. Traced their patent portfolios and publications to uncover overlooked references, including prototypes or experimental designs.

From our research, we discovered that one inventor has been working in this field for many years. We searched for this inventor's patents in the Orbit database and found 43 patents associated with them. After analyzing these 43 patents, we identified a good prior art reference.

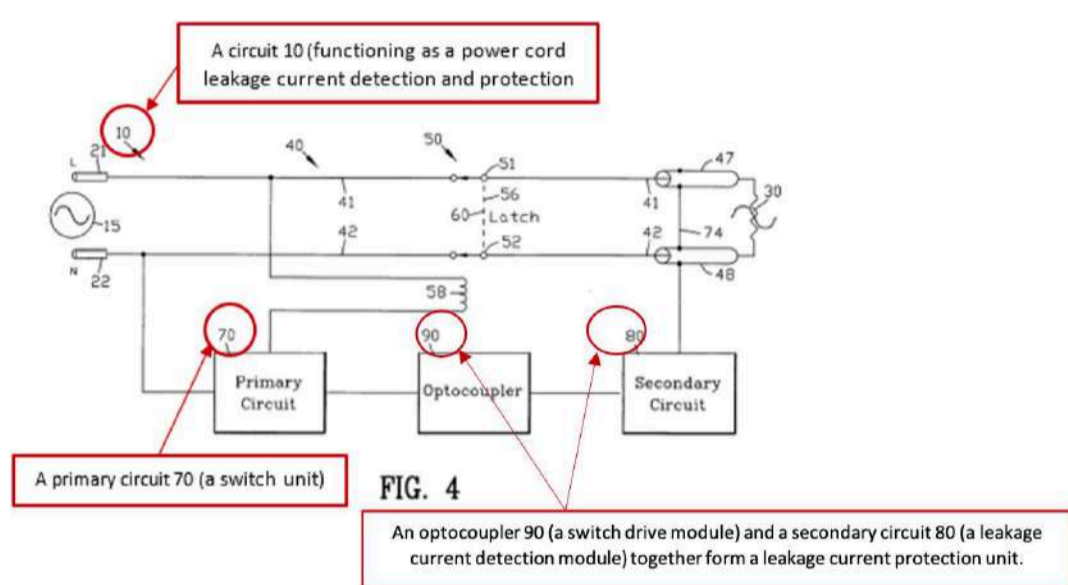
But we didn't stop there! During our analysis of the 43 patents, we also examined the circuitry involved. This helped us create a string based on the circuit design. In this string, we used specific terminology related to circuits, such as primary circuit, secondary circuit, optocoupler, power source, conductive shield, trip coil SOL, SCR, and more. This strategy led us to find another relevant reference.

BREAKTHROUGH FINDINGS

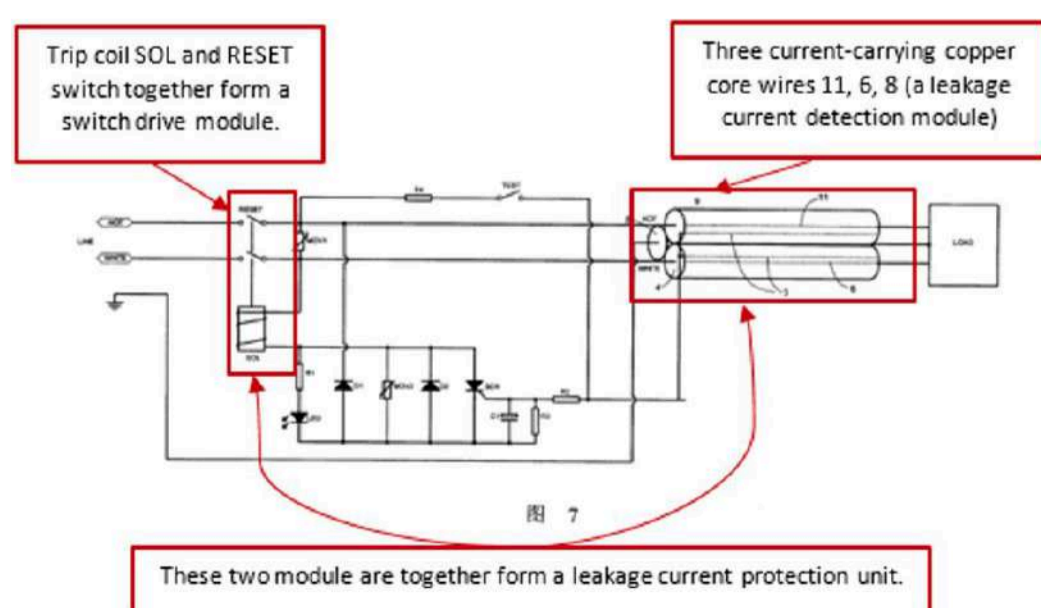
The refined search uncovered critical prior art that, when combined, disclosed all features of the patented invention:



► **Prior Art 1:** A US patent described a circuit designed to disconnect a power source upon detecting a leakage current. The circuit consists of a power cable with insulated first and second wires enclosed by a conductive shield. A drain wire makes electrical contact with the conductive shield. A disconnect switch was positioned between the power source and the power cable, with a primary circuit controlling its operation. However, the prior art fails to describe “the signal feedback line was coupled via the first detection module to one of the first power supply line and the second power supply line.



► **Prior Art 2:** A CN patent describes a protection circuit for electrical leakage, comprising a power cord capable of detecting leakage phenomena and a leakage-detecting circuit. The power cord consists of three current-carrying copper cores and a leakage detection conductor utilized to identify leakage phenomena. The leakage-detecting circuit comprises a silicon-controlled rectifier, a diode, a resistance, and a trip coil with an inner iron core.



OUTCOME AND IMPACT

► **Novelty Invalidated:** References themselves and the combination of references demonstrated that the design to detect and protect against leakage current in a power cord was not novel.

► **Inventor Credibility:** The inventor’s prior work, which was established to detect and protect against leakage current in a power cord, was an obvious extension of existing solutions, weakening the patent’s “non-obviousness” argument.

CONCLUSION

To challenge a patent related to a leakage current detection and protection device for power cords, it’s important to use a careful and organized approach. We tackled the challenges through in-depth technical analysis, extensive prior art searches, and consultations with clients. We also prepared a claim chart for the relevant references, along with individual summaries for each one. Additionally, we included relevant text mappings of other references in the report, which could be used together to support claims of obviousness or TSM (teaching, suggestion, motivation) to help the client strengthen their arguments.

The client was very pleased with the references and the effort we made to uncover them.